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## CLAIMS

*What is claimed is:*

10   1.    A method of evaluating the configuration of a communication system, the method comprising:

selecting a system model;

collecting performance-characterizing data from the communication system;

comparing the collected data to the system model; and

15       modifying the system model.

2.    The method of Claim 1 wherein the steps of collecting performance-characterizing data, comparing the collected data to the system model and modifying the system model are performed iteratively.

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3.    The method of Claim 1 further comprising altering the operational mode of one or more users of the communication system.

4.    The method of Claim 1 wherein the step of selecting a system model comprises
25   selecting a plurality of potential system models;

further wherein the step of modifying the system model comprises selecting a subset of the plurality of potential system models that shows the maximum likelihood of being the actual system configuration.

5    5.    The method of Claim 1 wherein the performance-characterizing operational data comprises at least one of the following data types:

channel average attenuation measurements;

channel bit distributions;

channel transmit power levels;

10    reported current data rates;

reported maximum possible data rates;

reported error-correction-parity;

reported use of trellis codes;

measured channel insertion loss;

15    measured channel gain;

measured channel phase;

inferred data regarding individual users' power levels;

operational data regarding individual users' power levels;

inferred data regarding individual users' PSD levels;

20    operational data regarding individual users' PSD levels;

inferred data regarding individual users' code settings;

operational data regarding individual users' code settings;

inferred data regarding the parameterized shaped PSDs of potential noises;

operational data regarding the parameterized shaped PSDs of potential

25        noises;

the frequency/tone index of highest noise change in a recent time interval;

the total number of bit-swaps occurring in a recent time interval;

5      the distribution of FEC errors, code violations or errored seconds

violations over several successive sub-intervals of a time interval;

measured noise power variations;

measured peak-to-average power ratio;

measured channel logarithmic magnitude;

10      measured quiet-line noise levels;

measured active-line noise levels;

count of ATM or other protocol cells;

measured higher-level protocol-throughput;

count of retraining;

15      count of failed synchronization attempts;

reported carrier mask;

reported tone-shaping parameters; or

inferred data regarding vectored or matrix channel characterization;

20      6.      The method of Claim 1 further comprising the step of prompting data
transmission in the communication system to generate performance-characterizing data
for collection.

7.      The method of Claim 6 wherein prompting data transmission comprises sending
25      stimulation signals on inactive user lines or on lines not currently carrying DSL services
to provide a control signal or data set;

further wherein collecting performance-characterizing data comprises at least one
of the following:

5     measuring the effects of the stimulation signals on lines; or

      measuring the effects of normal operation signals on lines.

  8.  The method of Claim 1 wherein the communication system is a DSL system.

10 9.  A communication system configuration estimator comprising:

     means for collecting performance-characterizing data from a communication system, wherein the collecting means is coupled to the communication system; and

     means for estimating the configuration of the communication system based on the collected performance-characterizing data, wherein the estimating means is coupled to the

15 collecting means.

  10.  The estimator of Claim 9 wherein the communication system is a DSL system having a network management system, a management entity and a management information base coupled thereto;

20     further wherein the collecting means is coupled to at least one of the following:

       the network management system;

       the management entity; or

       the management information base.

25 11.  The estimator of Claim 9 wherein the collecting means is a computer and further wherein the estimating means is the computer.

  12.  The estimator of Claim 9 wherein the estimating means compares the collected

5   data to a model representing a potential system configuration.

13.   The estimator of Claim 12 wherein the collecting means collects performance-characterizing data on an ongoing basis; and

further wherein the estimating means is configured to modify the model to

10   conform the model to the collected data.

14.   The estimator of Claim 9 wherein the estimating means compares the collected data to a plurality of models of potential system configurations and selects the most likely model from the plurality of models based on the collected data.

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15.   The estimator of Claim 14 wherein the estimating means uses a maximum likelihood methodology to select the most likely model.

16.   The estimator of Claim 9 wherein the estimator is coupled to a controller, the

20   controller comprising means for generating and sending control signals to parts of the communication system, the control signals comprising instructions to the parts of the communication system regarding the mode of operation to be used by the parts of the communication system.

25   17.   A computer program product comprising a machine readable medium on which is provided program instructions for evaluating the configuration of a communication system, the program instructions comprising:

instructions for selecting a system model;

5 instructions for collecting performance-characterizing data from the communication system

instructions for comparing the collected data to the system model; and

instructions for modifying the system model.

10 18. The computer program product of Claim 17 wherein the communication system is a DSL system.

19. A method of estimating the configuration of a DSL system, the method comprising:

15 collecting performance-characterizing operational data from the DSL system, wherein collecting the operational data comprises receiving the operational data via element management protocols in the DSL system;

identifying a plurality of potential DSL system models;

comparing the collected operational data to each identified potential system model 20 in the plurality of potential system models; and

selecting the potential system model that most closely matches the collected operational data; and

setting the operating modes of users of the DSL system.

25 20. A method of estimating the configuration of a DSL system, the method comprising:

collecting performance-characterizing operational data from the xDSL system, the performance-characterizing operational data comprising at least one of the

5      following data types:

channel average attenuation measurements;

channel bit distributions;

channel transmit power levels;

reported current data rates;

10      reported maximum possible data rates;

reported error-correction-parity;

reported use of trellis codes;

measured channel insertion loss;

measured channel gain;

15      measured channel phase;

inferred data regarding individual users' power levels;

operational data regarding individual users' power levels;

inferred data regarding individual users' PSD levels;

operational data regarding individual users' PSD levels;

20      inferred data regarding individual users' code settings;

operational data regarding individual users' code settings;

inferred data regarding the parameterized shaped PSDs of potential noises;

operational data regarding the parameterized shaped PSDs of potential noises;

25      the frequency/tone index of highest noise change in a recent time interval;

the total number of bit-swaps occurring in a recent time interval;

the distribution of FEC errors, code violations or errored seconds

5              violations over several successive sub-intervals of a time interval;

               measured noise power variations;

               measured peak-to-average power ratio;

               measured channel logarithmic magnitude;

               measured quiet-line noise levels;

10             measured active-line noise levels;

               count of ATM or other protocol cells;

               measured higher-level protocol-throughput;

               count of retraining;

               count of failed synchronization attempts;

15             reported carrier mask;

               reported tone-shaping parameters; or

               inferred data regarding vectored or matrix channel characterization;

        identifying a plurality of potential xDSL system models;

        evaluating the correlation between each potential system model and the collected

20          operational data, wherein evaluating the correlation comprises at least one of the

            following:

               comparing observed operational data, generated by user use of the xDSL

                  system, to each identified possible system model in the plurality of

                  system models; or

25             comparing prompted operational data, generated by stimulating the xDSL

                  system, to each identified possible system model in the plurality of

                  system models; or

               comparing time-relative operational data, generated by creating time-

5      relative events within the xDSL system, to each identified possible system model in the plurality of system models;

      selecting one of the potential system models that most closely correlates to the operational data.

10   21.    A method of evaluating the Hlog function of a line in a DSL system, the method comprising:

      (1) setting a data-bearing frequency carrier mask;

      (2) transmitting data using one or more frequencies in the carrier mask;

      (3) receiving an attenuation value for the transmitted data;

15      (4) plotting the attenuation value; and

      (5) repeating steps (1)-(4) using one or more different carrier masks.

22.    The method of Claim 21 wherein f is the only frequency in each carrier mask and the corresponding received attenuation value is the insertion loss of the line for f.

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23.    The method of Claim 21 wherein the data-bearing carrier mask comprises a band of frequencies having a lower bound of f and further wherein the received attenuation value is an approximation of the insertion loss of the line for f.

25   24.    The method of Claim 21 further comprising:

      (6) approximating the channel transfer function of the entire DSL system usable frequency range on the basis of received attenuation values.

5    25.    The method of Claim 24 further comprising:

(7)  removing undesirable effects from the approximated channel transfer

function.

26.    The method of Claim 21 further comprising:

10         (6)  determining at least one of the following values for the line:

QLN;

MSE; or

SNR.

15    27.    The method of Claim 26 further comprising:

(7)  setting or recommending the operational mode of part of the DSL system

based on at least one of the following values for the line:

Hlog;

QLN;

20         MSE; or

SNR.

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28.     A method of computing the MSE noise of a line in a DSL system, the method
comprising:

estimating the Hlog function of the line;

obtaining the PSD function of the line;

10          obtaining the SNR function of the line; and

computing the MSE noise by subtracting the SNR from the sum of the PSD and
    Hlog.


29.     The method of Claim 28 wherein the SNR function is directly reported.

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30.     The method of Claim 28 wherein the SNR function is computed based on at least
one of the following:

the reported past bit distributions;

the reported current bit distributions;

20          the initial PSD;

the Hlog function; or

the QLN; and


31.     The method of Claim 28 wherein obtaining the PSD function comprises
25     estimating a PSD function or collecting a reported PSD function.